

RESEARCH PAPER

Agro-morphological and molecular characterization of traditional rice varieties collected from hilly zone of Karnataka

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Abstract: Fifty five rice genotypes were characterized at the Zonal Agricultural and Horticultural Research station, Navile, Shivamogga, during *kharif* 2017 by following the DUS (distinctiveness, uniformity and stability) test guidelines of PPVFRA (Protection of Plant Varieties & Farmer's Right Act). Significant variation was observed for the characters like coleoptile colour, intensity of leaf green color, culm attitude, flag leaf attitude, stem length, lemma and palea colour, grain length and test weight. In contrast, characters like presence of ligule, shape of ligule, presence of leaf auricle and leaf auricle colour had lesser variability. The results of molecular analysis revealed that only few markers like RM10964, RM 3412 and RM140 showed polymorphism. Some of the unique traits like anthocyanin colouration of leaf, coleoptile *etc.*, could be used as a morphological markers in breeding program. The genotypes with desirable traits can be used as donor parent in varietal development programme.

Key words: Morphological marker, Molecular characterization, Rice

Introduction

Rice is a staple food crop for more than half of the world's population. Green revolution has brought a remarkable change in rice production by introducing dwarf and fertilizer responsive varieties to attain food security. Subsequently, with introduction of these new high yielding varieties has brought a threat to conventional farmers' varieties, which are having broad genetic base and adaptation to changes in environment. About 50,000 rice accessions are still grown in the country, which are known to have important traits.

Characterization and documentation of rice genotypes is equally important along with their conservation. Therefore, the PPVFRA 2001 (Protection of Plant Varieties & Farmer's Right Act), has been enacted, for protection of varieties based on distinctiveness, uniformity and stability (DUS) test. Karnataka is also one of the major rice producing states with rich genetic diversity. Therefore the morphological and molecular characterization and documentation of some of the landraces of Karnataka has been carried out.

Material and methods

The experiment was conducted in *kharif* 2017 at Zonal Agricultural and Horticultural Research station, Navile, Shivamogga, to evaluate the 55 rice germplasm accession in an Randomized Block Design with two replications. Twenty-one days old seedlings were transplanted manually by placing single seedling per hill. The distance between row to row and plant to plant was 20 cm and 15 cm, respectively. Gap filling was done within a week in order to maintain uniform plant

population. Recommended Package of practices was followed to maintain the healthy crop.

Distinctiveness, uniformity and stability characterization was done by following the DUS test guidelines of PPVFRA. Observations were recorded from five randomly selected plants from each genotype and frequency distribution for each character was calculated. DNA of 55 rice genotypes was extracted following CTAB method and the PCR amplification was carried out using SSR markers (RM3412, RM10964, RM140, RM10864, RM10927, RM10825, RM10748 and SC3) at Molecular laboratory, Department of Genetics and Plant Breeding, UAHS, Shivamogga and molecular analysis was done.

Results and discussion

The 55 rice genotypes showed high degree of difference for qualitative and quantitative character studied. All genotypes had cleft type of leaf ligule. Rajanna *et al.* (2011) reported similar result for presence of ligule and cleft shape of ligule. Sanyal and Joshi (2016) observed variation in basal leaf sheath colour (green and purple-lines). Umarani *et al.* (2017) noticed red colouration of auricle, purple stigma, anthocyanin colouration of nodes and red apiculus colour.

Agro morphological characters varied significantly among the genotypes studied (Table 1). Out of 55 genotypes studied 31 genotypes had purple coleoptile colour and the remaining genotypes had green colour (Fig. 1a). Intensity of green colour of leaf varied significantly *i.e.*, 49 per cent of the genotypes had medium green leaf colour, 40 per cent of the genotypes had dark green leaf colour, 9 per cent of genotypes showed light green

Table 1. Frequency distribution and number of genotypes of each local rice genotype having each unique character

Character	Status (Number of genotypes, frequencies %)
Coleoptile: Colour	Green (24, 43.63) and Purple (31, 56.36)
Basal leaf: sheath colour	Green (44,80), Light Purple (6, 10.9), Purple- lines (3, 5.5) and Uniform purple (2, 3.6)
Leaf: intensity of green colour	Light (5, 9.1), Medium (27, 49.1), Dark (22, 40) and mixed (1, 1.8)
Leaf auricles	Present (45, 81.8) and Absent (10, 18.2)
Anthocyanin colouration of auricles	Absent (10, 18.18), Yellowish green (43, 78.2), Purple (1, 1.82) and Purple line (1, 1.82)
Leaf ligule	Present (55, 100)
Leaf shape of ligule	Cleft (55, 100)
Leaf: colour of Ligule	Whitish (47, 85.5), Purple (2, 3.6) and Purple line (6, 10.91)
Culm attitude	Erect (4, 7.3), Semi erect (20, 36.3) and open (31, 56.4)
Stem: length (in cm)	Long (34, 61.81), Very long (15, 27.3),Medium (3, 5.5), Very short (2, 3.63) and Short (1, 1.82)
Lemma and Paleacoulour	Green (8, 14.5), Brown furrow (18, 32.72), Purple (3, 5.5), Brown tanny (12, 21.81), Gold & Gold furrow (8, 14.55), Purple furrow (3, 5.5) and Yellowish green (3, 5.5)
Panicle: Exertion	Well exerted (26, 47.27), Partially exerted (16, 29.09) and Mostly exerted (13, 23.63)
Grain: width	Very broad (1, 1.82), Narrow (8,14.5), Medium (31, 56.36), Broad (13, 23.63) and Very narrow (2, 3.6)
Grain length	Medium (24, 43.6) and Short (31,56.36)
Test weight	Very high (5, 9.1), High (24, 43.63), Medium (21, 38.18), Low (4, 7.3) and Very low (1, 1.8)

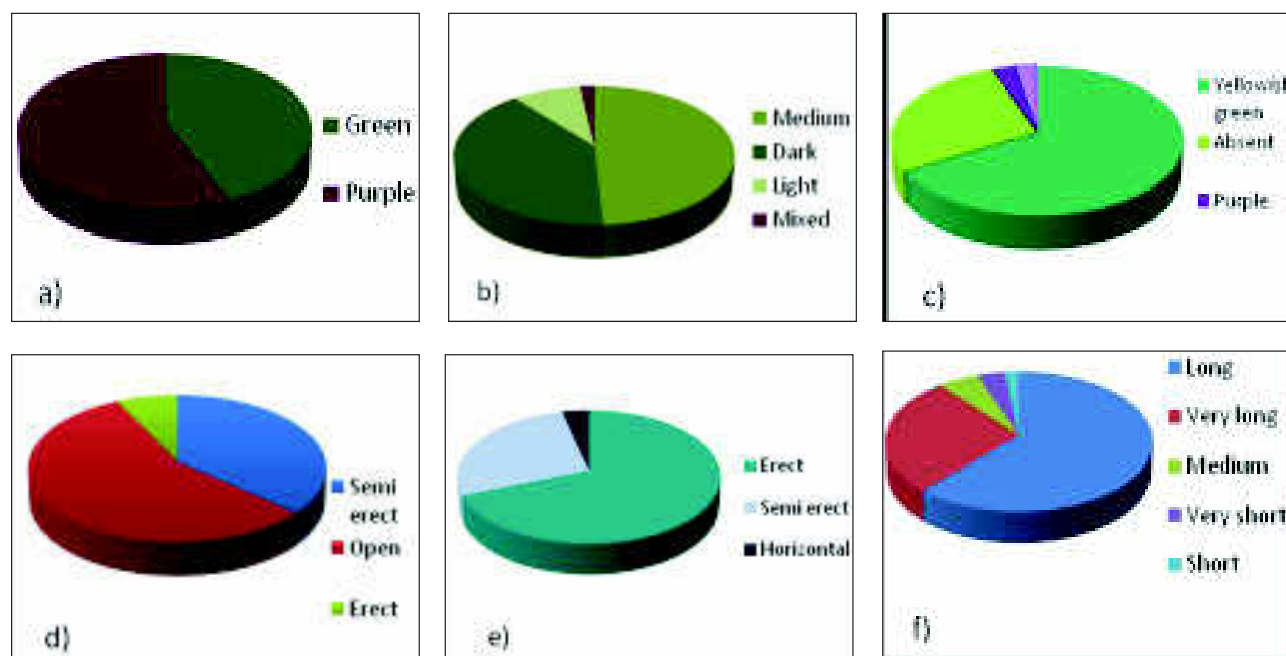


Fig. 1. Pie charts showing frequencies of a) Coleoptile colour b) Leaf intensity of green colour c) Leaf auricle colour d) Culm attitude e) Flag leaf attitude f) Stem length

leaf colour and interestingly mixed green colour was found in only one genotype, Krishnaleela with uniform anthocyanin colouration of leaf (Fig. 1b). Leaf auricle was present in 45 genotypes and absent in 10 genotypes. Majority of the genotypes showed yellowish green colour auricle and only two genotypes Bilikannuhegga and Valtiga had anthocyanin colour (Fig. 1c).

Open (56%) and semi erect (36%) types dominated in culm attitude among the genotypes studied over erect (7%) type (Fig. 1d). There was much variation observed in stem length from very short to very long (Fig. 1f). Majority of the genotypes showed erect flag leaf attitude (70%) compared to semi erect (27%) and horizontal (4%) (Fig. 1e). Lemma and palea colour is a good character to distinguish between the genotypes which can be



Fig. 2. Gel picture showing PCR amplification of RM10964 marker

used as marker in varietal identification. Fifty seven per cent of genotypes had medium grain length and 43 per cent of genotypes had short grain length. Majority of genotypes showed medium grain width and few genotypes were broad and very broad. High grain test weight was observed in 24 genotypes, five genotypes showed very high grain weight, 21 genotypes showed medium grain weight, four genotypes showed low and very low was found in one genotype (Table 1). Molecular analysis was carried out using SSR markers out of different markers studied only few markers like RM10964, RM 3412 and RM140 could distinguish between the genotypes (Fig. 2).

Rice germplasms possessed exclusive variability and unique features which need safe conservation, documentation and utilization in varietal development program. Genotypes like Krishnaleela (uniform anthocyanin colouration of leaf), Bilikannuhegga (purple colour of auricle) and Valtiga (purple ligule colour) were found to be most distinctive for the characters studied. Characters like anthocyanin colouration of coleoptile, leaf blade, basal leaf sheath, leaf auricle, ligule, which are unique could be used as a morphological marker and utilized in breeding programme.

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